

## Lower Cretaceous Conchostracans of SW Japan

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**Abstract** Four species of *Yanjiestheria* and a new species *Neodiastheria yamajiensis* sp. n. from the Inakura Formation at Yamaji of Ibara City, Okayama Prefecture have been first described in this paper. Three conchostracan forms from the Wakino Subgroup in Kokura area, Kitakyushu City have been restudied and revised in taxa. They are *Ortheastheria kokurensis* (KUSUMI), *Ortheastheriopsis imamura* (KUSUMI), and *O. wakinoica* sp. n. Based on this research, the correlation of the Lower Cretaceous volcano-sedimentary strata has been rediscussed.

The Lower Cretaceous conchostracans of SW Japan were firstly discovered by Akira Hase in 1948 from the Upper Wakamiya Formation (W<sub>4</sub>) of the Wakino Subgroup, Kwanmon Group at Eri, Kokura of Kitakyushu City. Later some new materials were found from the Inkstone Group at Inakura of Okayama Prefecture and Sasayama of Hyogo Prefecture. Prof. Hisashi KUSUMI (1960, 1961) described the collection from Kokura area under the taxa of *Euestheria kokurensis* KUSUMI (A form), *Estherites imamura* KUSUMI (B form), and C form, figured several unnamed specimens from Inakura and Sasayama areas as well. During the excavations of the Cretaceous fish fossils from W<sub>4</sub> of the Wakino Subgroup at Kumagai, Kokura-kita-ku, Kitakyushu City in 1976 and 1977, Dr. M. Ota and his colleagues collected a lot of conchostracan fossils which are associated with fish fossils. In the report of the second excavation (OTA *et al.*, 1978), KUSUMI named "C form" *Cyclestherioides* sp. based on its subcircular outline of the carapace (pl. 13, figs. 6–8).

In 1991 and 1994, the present author investigated several localities of the Lower Cretaceous conchostracans around Kitakyushu City and along the boundary between Hiroshima and Okayama Prefectures twice. These specimens described in this paper are mainly from the Upper Wakamiya Formation (W<sub>4</sub>) of the Wakino Subgroup at Kumagai and from the Yamaji shale of the Inakura Formation at Yamaji of Ibara City, Okayama Prefecture, SW Japan (Fig. 1). They can be classified into 8 species in 4 genera, two of them are new forms.

The Yamaji shale in Ibara area yields following fossil conchostracans:

*Yanjiestheria kyongsangensis* (KOBAYASHI & KIDO)

*Y. huzitai* (KOBAYASHI & KIDO)

*Y. chekiangensis* (NOVOJLOV)

*Y. aff. brevis* CHEN & SHEN

*Neodiestheria yamajiensis* (sp. n.)

Among them, the first two species were found from the Kyongsang Supergroup of South Korea, the Shouchang Formation of western Zhejiang Province and equal horizons of other provinces of SE China. *Yanjiestheria chekiangensis* is widely distributed in the Lower Cretaceous deposits of northern and southeastern China. It was first reported from the Shouchang Formation of Zhejiang Province. *Y. brevis* is also found from this formation and these specimens of Yamaji of SW Japan are closely related to it with exception of the number of growth bands. *Neodiestheria* is another leading form of Lower Cretaceous conchostracans in China. In this paper the author described a new species *N. yamajiensis* from the Inakura Formation of Okayama Prefecture, SW Japan. The author hopes that some forms of this genus will be reported from the Kyongsang Group of south Korea in the near future. Generally speaking, the conchostracan fauna of Yamaji shale is closely related to that of the Shouchang Formation in SE China instead of the conchostracan fauna of the Wakino Subgroup. This fauna dominated by *Yanjiestheria* and *Neodiestheria* might be early Lower Cretaceous (Neocomian) in age (CHEN & CHANG, 1994).

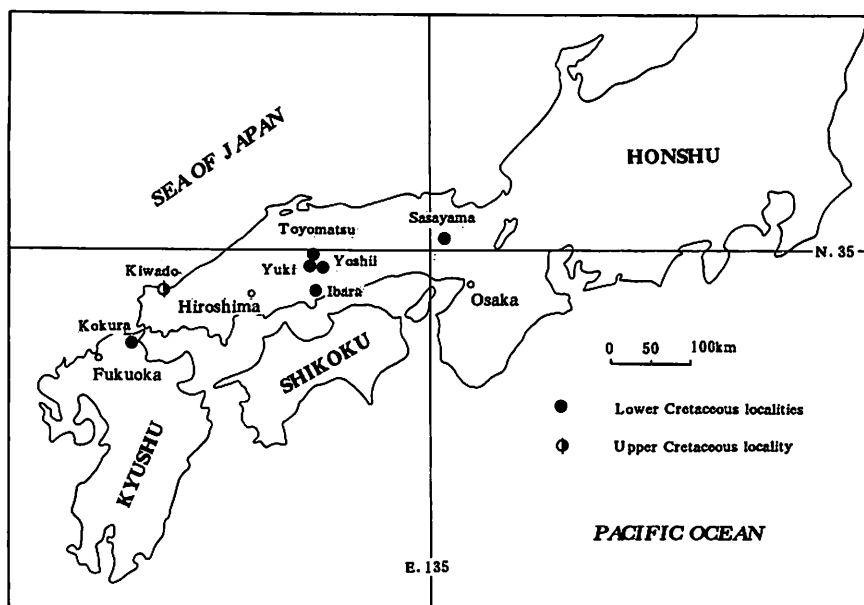


Fig. 1. Cretaceous conchostracan localities in SW Japan (after KUSUMI 1961, with some modification )

The fossil conchostracans to be found from the Wakino Subgroup in Kokura area of Kitakyushu City, SW Japan are monotonous in taxa including *Orthesstheria*

*kokurensis*, *Ortheastheriopsis imamura* and *Ortheastheriopsis wakinoica*. Of them, the first two species were reported from the Guantou Formation of Zhejiang Province, SE China. *O. wakinoica* is a new species which was described as "C form" or *Cyclestherioides* sp. by KUSUMI (1960, 1961, 1978). *Ortheastheria* and *Ortheastheriopsis* are most important forms of the conchostracan fauna of the Guantou Formation in addition to the leading species *Cratostracus zhejiangensis* CHEN. The appearance of *O. kokurensis*, *O. imamura* and *Yungkangichthys*, a fish fossil (YABUMOTO, 1994, p. 142–146), in both of the Wakino Subgroup and the Guantou Formation supports their correlation each other of these two stratigraphic units. They are very probably late Lower Cretaceous (Aptian) in age.

Prof. K. H. CHANG (1985, 1988) divided the Kyongsang Supergroup into the Sindong Group below and the Hayang Group above, and further subdivided the former into the Nakdong, Hasandong and Jinju Formations in ascending order. Meanwhile, he also subdivided the latter into the Konchonri, Jindong, Banyawol, Silla, and Chilgok Formations in descending order. He proposed that the Sindong

area age		SE China	SW Japan		S Korea	
		Zhejiang	Kitakyushu	Hiroshima. Okayama		
Lower Cretaceous	Alb.	?	Kwanmon Group	Shimonoseki Subgr.	?	??
	Apt.	Guantou Fm		Wakino Subgr.		
	Barr.	Hengshan Fm		Inakura Fm	Kyongsang Supergroup	Hayang Gr.
		Shouchang Fm				
	Haut.	Huangjian Fm				
		Laocun Fm				
	Valang.					
	Berr.					

Fig. 2. Stratigraphic correlation of Lower Cretaceous volcano-sedimentary rocks of SW Japan, S Korea, and SE China.

Group is Hauterivian to Barremian in age because of the appearance of charophyte *Clypeator jiuquanensis* WANG in the Nakdong Formation, and the Hayang Group is Aptian to early Albian in age based on a research on fossil pollen grains collected from the Konchonri Formation in which there are also many conchostracan fossils as in the Jinju Formation. The author visited several localities of fossil conchostracans from these two formations in the Kyongsang Basin during the 2nd International Symposium of IGCP 350 at South Korea in 1994. The fossil conchostracans from both of the Jinju and Konchonri formations were first described by Kobayashi and Kido (1947). They have very similar feature in outlines of carapaces and ornamentations of growth bands, and could be mostly referred to *Yanjiestheria* or *Neodiestheria* (ZHANG *et al.*, 1976; CHEN & SHEN, 1982). Therefore, the Kyongsang Supergroup (except the Yuchon Group) seems to be correlated with the Inkstone (Inakura) Group in SW Japan or the Kienteh Group including the Shouchang, Huangjiang and Laocun formations except the Guantou Formation) in SE China. They are early Lower Cretaceous (Hauterivian to Barremian) in age (Fig. 2).

**Systematic Palaeontology**  
**Order Conchostraca Sars, 1867**  
**Suborder Estheritina KOBAYASHI, 1972**  
**Superfamily Lioestherioidea RAYMOND, 1946**  
**Family Eosestheridae ZHANG & CHEN, 1976**  
**Genus *Yanjiestheria* CHEN, 1976**

**Type species:** *Yanjiestheria bellula* CHEN, 1976. Dalazi of Yanji County, eastern Jilin Province; Lower Cretaceous Dalazi Formation.

**Diagnosis:** Carapace of moderate size, elliptical, oval, subcircular or subtriangular in outline; crowded and small reticulate sculpture in the growth bands near the dorsal side or anteroventral region, irregular and deep meshes less than 0.02 mm in size; slender or irregular radial linear sculpture in the growth bands near the ventral side or the postero-ventral region, bifurcated upwards or downwards, cross bars in between; a few transition growth bands with reticulate and linear sculpture in the middle of valve.

**Remarks:** *Yanjiestheria* and *Eosestheria* are much alike in outline and in the pattern of sculpture, but the former differs from the latter in contracted small-sized meshes, and thinned and crowded radial striae. It seems to be derived from the late Jurassic genus *Eosestheria*.

**Distribution:** China, Korea, Japan and Transbaikalia; latest Jurassic to Cretaceous (mainly Early Cretaceous).

***Yanjiestheria kyongsangensis* (KOBAYASHI & KIDO)**

(Pl. 2; figs. 1-2)

- 1947 *Estherites kyongsangensis* KOBAYASHI & KIDO, Japan. Jour. Geol. Geogr., Vol. 20, No. 1, pl. 18, figs. 1-5. figs. 8-10.  
 1954 *Euestheria kyongsangensis* (KOBAYASHI & KIDO), KOBAYASHI: Jour. Fac. Sci. Univ. Tokyo. Sec. 2, Vol. 9, pt. 1. p. 72  
 1976 *Yanjiestheria kyongsangensis* (KOBAYASHI & KIDO), ZHANG *et al.*: Fossil Conchostraca of China. p. 164-165; pl. 50, figs. 1-4.  
 1982 *Yanjiestheria kyongsangensis* (KOBAYASHI & KIDO), CHEN and SHEN: Palaeontologia Sinica, New Ser. B. no. 17, p. 52, pl. 8, figs. 5-6; pl. 13, figs. 9-13; pl. 14, fig. 3.

**Materials:** Two specimens collected from the Yamaji shale of the Inakura Formation (or Inakura Inkstone Group) near Yamaji, Ibara City of Okayama Prefecture, SW Japan. Collect. no. IK-5 & 6; Cat. no. KMNH (Kitakyushu Museum and Institute of Natural History) IvP 500,001-500,002.

**Description:** A shifted carapace of moderate, long oval in outline, 12 mm long, 7 mm high. Dorsal margin straight and long, with umbo at its anterior end. Posterior height more than anterior one, ventral margin broadly curved downwards. About 50 narrow growth bands ornamented with crowded granules and short strips near the antero-ventral region and dorsal side, whereas the slender and irregular radial linear sculpture near the postero-ventral region of valve and the cross bars in between.

**Remarks:** Due to this figured specimen is an external mould of right valve (pl. 2, figs. 1-2), these crowded granules and short strips of growth bands near the antero-ventral region indicate the small reticulate sculpture in surface of the valve, and they are somewhat linearized.

**Locality and horizon:** Yamaji of Ibara City, Okayama Prefecture, SW Japan; Lower Cretaceous Yamaji Shale of the Inakura Formation, Inkstone Group.

***Yanjiestheria huzitai* (KOBAYASHI & KIDO)**

(Pl. 1, figs. 6-8)

- 1947 *Estherites kyongsangensis* var. *huzitai* KOBAYASHI & KIDO, Japan. Jour. Geol. Geogr., Vol. 20, no. 2, p. 88, pl. 18, fig. 6.  
 1954 *Euestheria huzitai* (KOBAYASHI & KIDO), KOBAYASHI: Jour. Fac. Sci. Univ. Tokyo, Sec. 2, vol. 9, pt. 1, p. 72.  
 1982 *Yanjiestheria huzitai* (KOBAYASHI & KIDO), CHEN & SHEN: Palaeontologia Sinica, New Ser. B, no. 17, p. 51, pl. 10, fig. 6; pl. 11, fig. 10.

**Materials:** Three specimens collected from the Yamaji Shale of the Inakura Formation near Yamaji. Ibara City of Okayama Prefecture, SW Japan. Collect. no. IK-1, 2b, 19b; Cat. no. KMNH IvP 500,003-500,005.

**Description:** carapace of moderate size, elliptical in outline, 11-13 mm long,

6.5–8 mm high. Dorsal margin straight and long with umbo between its centre and anterior end. Anterior high much more than posterior one, posterior end of carapace obviously contracted. Ventral margin broadly curved downwards. Growth band relative wide, about 17 in number, ornamented with crowded small strips and granules, which are linearized.

**Locality and horizon:** This species is associated with *Y. kyongsangensis* near Yamaji.

***Yanjiestheria chekiangensis* (NOVOJLOV)**

(Pl. 1, figs. 1–5)

- 1931 *Estheria elliptica* DUNKER var. *intermedia* CHI, Bull. Chinese Geol. Soc. Vol. 10, p. 210, pl. 1, fig. 11.  
 1954 *Bairdestheria chekiangensis* NOVOJLOV, Trudy Palaeontological Institute of USSR, no. 48, p. 72, pl. 13, fig. 10.  
 1976 *Yanjiestheria chekiangensis* (NOVOJLOV). ZHANG *et al.*: Fossil Conchostraca of China, p. 167, pl. 51, figs. 6–8.  
 1982 *Yanjiestheria chekiangensis* (NOVOJLOV), CHEN and SHEN: Palaeontologia Sinica. New Ser. B, no. 17, p. 52, pl. 8, fig. 4; pl. 12, figs. 9–12; pl. 16, fig. 6.

**Materials:** Five specimens collected from the Yamaji Shale of the Inakura Formation near Yamaji, Ibara City of Okayama Prefecture, SW Japan. Collect. no. IK-1, 2a, 14, 19a, 20; Cat. no. KMNH IvP 500,006–500,010.

**Description:** Carapace of moderate size, subcircular in outline, 7–11.5 mm long, 6.3–9.1 mm high. Dorsal margin short with umbo at its anterior end. Antero-ventral margin broadly curved downwards, anterior margin more or less straight, posterior end of valve slightly contracted. 26–35 growth bands with small and crowded reticulate sculpture near the dorsal side or antero-ventral region, slender and irregular radial linear sculpture near the postero-ventral region, transitional sculpture from the small reticulations to the radial striae in the central region of valve (Pl. 1, fig. 3).

**Remarks:** The holotype of this species was collected from the Lower Cretaceous Shouchang Formation in western Zhejiang Province of SE China. It is an external mould of left valve and has about 35 narrow growth bands ornamented with crowded granules, short strips, and radial striae. These specimens collected from the Yamaji Shale of the Inakura Formation in Okayama Prefecture, SW Japan and described as *Y. chekiangensis* in this paper are very similar to the holotype according to the outline of carapace and sculptures, but some individuals (pl. 1, figs. 1, 4) have relatively wide growth bands.

**Locality and horizon:** Same as above-mentioned two species.

***Yanjiestheria* aff. *brevis* CHEN & SHEN**

(Pl. 4, figs. 7–8)

1982 *Yanjiestheria brevis* CHEN & SHEN, Palaeontologia Sinica, New Ser. B, no. 17, p. 54, pl. 14, fig. 2; pl. 15, fig. 7.

**Materials:** Six Specimens collected from the Yamaji Shale of the Inakura Formation near Yamaji, Ibara City of Okayama Prefecture, SW Japan. Collect. no. IK-7–12, Cat. no. KMNH IvP 500,011–500,012; 500,044–500,047.

**Description:** This is an external mould of right valve, moderate in size, short-oval in outline, 8.4 mm long, 6.9 mm high. Dorsal margin short with umbo near its centre. Both of anterior and posterior margins relatively straight, postero-ventral margin expended and curved obliquely backwards. About 30 growth bands ornamented with crowded granules and short strips which are somewhat linearized.

**Remarks:** The holotype of this species, was found from the Lower Cretaceous Shouchang Formation in Zhejiang Province, SE China. It has about 50 narrow growth bands. These specimens of Yamaji described as *Y. aff. brevis* in this paper are very similar to the holotype of Zhejiang in all aspects only except the number of growth bands.

**Locality and horizon:** Same as above-mentioned three species.

**Genus *Neodiestheria* CHEN, 1976**

**Type species:** *Neodiestheria gigantea* CHEN, 1976. Near Badaohe Station of Yanji county, Jilin; Lower Cretaceous Dalazi Formation.

**Diagnosis:** This genus is frequently associated with *Yanjiestheria* in the Lower Cretaceous deposits and it is similar to the latter in the pattern of the sculpture of growth bands, but differs from the latter in bearing large transverse overlapped reticulations in the upper half of each growth band or occupying whole intervals between growth lines in the ventral and postero-ventral regions of the valve.

**Distribution:** China, Japan and Korea; Early Cretaceous.

***Neodiestheria yamajiensis* sp. n.**

(Pl. 2, figs. 3–7)

**Holotype:** Cat. no. KMNH IvP 500,013, Collect. no. IK-18, collected from the Yamaji Shale of the Inakura Formation near Yamaji, Ibara City of Okayama Prefecture, SW Japan.

**Paratypes:** Collect. no. IK-3, 16, 17, 18, 21; Cat. no. KMNH IvP 500,014–500,017 collected from the same site of the holotype.

**Description:** Holotype is an external mould of the left valve (IK-18, pl. 2, fig.

3), moderate in size, elliptical in outline, 8.7 mm long, 5.4 mm high. Dorsal margin long with umbo between its centre and anterior end. Anterior margin straight, posterior margin rounded, ventral margin broadly curved downwards. Growth bands broad and flattened, 13 in number, ornamented with obvious large transverse overlapped reticulations, whereas weak sculpture of the pattern of *Yanjiestheria* below them (Pl. 2, figs. 5–6).

Paratype is a left valve (IK-3, Pl. 2, fig. 4), moderate in size and elliptical in outline, 11 mm long, 5.7 mm high. Anterior half of the dorsal margin broken, growth bands more than 13 in number.

**Comparison:** This new species is closely related to *Neodiestheria changdongensis* CHEN (ZHANG *et al.*, 1976, pl. 65, figs. 1–6; pl. 66, figs. 1–4) from the Lower Cretaceous Dalazi Formation of eastern Jilin Province, NE China in having similar sculpture of growth bands, but the latter differs from the former in rhombic valve and in subcentral umbo.

*N. yamajiensis* is also similar to the type species, *N. gigantea* CHEN (ZHANG *et al.*, 1976, pl. 64, fig. 1–7) in outline of the valve and in broad growth bands, but the latter differs from the former in having the large transverse overlapping reticulations only in the upper half of each growth band.

**Locality and horizon:** Same as above mentioned four species.

### Superfamily Estheciteoidea ZHANG *et al.*, 1976

#### Family Fushunograptidae WANG, 1974

#### Genus *Orthestheria* CHEN, 1976

**Type species:** *Orthestheria pecten* CHEN, 1976. Luoquangou of Jiaohe County, Jilin; Lower Cretaceous Baojiatun Formation.

**Diagnosis:** Carapace small and thick, elliptical, oval, rhombical, rectangular, circular or subquadrate in outline; growth bands ornamented with many regular radial striae, striae fine or coarse, usually more straight, without other structure in between.

**Distribution:** China, Japan, England and Germany; Cretaceous.

#### *Orthestheria kokurensis* (KUSUMI)

(Pl. 3, figs. 1–2)

- 1960 *Euestheria kokurensis* KUSUMI (A form), Jour. Sci. Hiroshima Univ., Ser. C, vol. 3, no. 1, p. 17–20, pl. 4, figs. 1–3, 10.  
 1961 *Euestheria kokurensis* KUSUMI (A form), KUSUMI: Geol. Rep. Hiroshima Univ., no. 7, pl. 6, fig. 5; pl. 7, fig. 6.  
 1976 *Orthestheria yongkangensis* CHEN, ZHENG *et al.*: Fossil Conchostraca of China, p. 186, pl. 7, figs. 1–6.  
 1978 *Euestheria kokurensis* KUSUMI (A form), Rep. second excav. Cret. fish fossils in Kokura,



Kitakyushu City, Japan, p. 17, pl. 3, figs. 1–3.

1982 *Ortheastheria yongkangensis* CHEN, CHEN & SHEN: Palaeontologia Sinica, New Ser. B, no. 17, p. 59, pl. 20, figs. 2–4; pl. 27, figs. 7–8.

**Materials:** Two specimens from the Upper Wakamiya Formation (W<sub>4</sub>) of Wakino Subgroup at Kumagai, Kokura-kita-ku, Kitakyushu City, SW Japan, Collect. no. KA-O-6d1, 6d9, Cat. no. KMNH IvP 500,018–500,019.

**Description:** Carapace of small size, oblongly ovate or elliptical in outline, 5.9–6.2 mm long, 3–3.3 mm high. Dorsal margin relatively long with umbo between its centre and anterior end. Growth bands narrow, countable 22–26 on the valve except for the umbonal side, where they are not well-preserved. Sculpture or ornamentation of the growth bands are simple and radial striae.

**Remarks:** For *Euestheria* the type-species, *E. minuta* (ZIETEN), was found from the Upper Triassic rocks of Germany with typical small reticulate sculpture of growth bands (REIBLE, 1962, pl. 7, figs. 4–5). According to the ornamentation of radial striae, the present writers propose to refer this species (*E. kokurensis* KUSUMI, 1960) to genus *Ortheastheria* which is widely distributed in the Cretaceous deposits of eastern Asia and western Europe.

*Ortheastheria yongkangensis* CHEN from the Aptian Guantou Formation of Zhejiang Province, SE China is characterized by small elliptical carapace and radial linear sculpture of growth bands. It probably be a junior synonym of *O. kokurensis* (KUSUMI).

KUSUMI (1960) described 24 specimens under this species. They are 5–7.2 mm long, 3–4.2 mm high, 26–40 growth bands. He cannot split them into distinct species by number of growth bands or by ornamentation for they are all radial striae, but he considered that this species is distinguishable from B and C forms by the oblongly ovate outline of the carapace and subterminal umbo on the dorsal margin (KUSUMI, 1960, :20).

**Locality and horizon:** Kumagai, Kokura-kita-ku, Kitakyushu City, SW Japan; Lower Cretaceous Upper Wakamiya Formation (W<sub>4</sub>) of the Wakino subgroup, Kwanmon Group.

### Genus *Ortheastheriopsis* CHEN, 1976

**Type species:** *Ortheastheriopsis dajingensis* CHEN, 1976. Dajing village near Puchanghe town, Xiangyun county of Yunnan, SW China; Lower Cretaceous Puchanghe Formation.

**Diagnosis:** Carapace smaller in size, circular, elliptical, oval, rhomboid, or subquadrate in outline, dorsal margin long or short, with umbo anterior or central, growth bands slightly broad, ornamented with slender and regular radial striae, many very fine cross bars in between.

**Comparison:** This genus is very similar to *Ortheastheria*, but it differs from the

latter in having the cross bars between the radial striae of growth bands.

**Distribution:** China and Japan; Cretaceous.

***Ortheastheriopsis imamura* (KUSUMI)**

(Pl. 3, figs. 3–5)

- 1960 *Estherites imamura* KUSUMI (B form), Jour. Sci. Hiroshima Univ., Ser. C, vol. 3, no. 1, p. 20–22, pl. 4, figs. 4–6. 11.  
 1961 *Estherites imamura* KUSUMI (B form), Geol. Rep. Hiroshima Univ. no. 7, pl. 6, fig. 6; pl. 7, figs. 7–8.  
 1978 *Estherites imamura* KUSUMI (B form), Rep. second excav. Cret. fish fossils in Kokura, Kitakyushu City, Japan, p. 17, pl. 13, figs. 4–5.  
 1982 *Ortheastheriopsis guantouensis* CHEN & SHEN, CHEN & SHEN: Palaeontologia Sinica, New Ser. B, no. 17, p. 63, pl. 24, figs. 3–6.

**Materials:** Four specimens to be found from the Upper Wakamiya Formation (W<sub>4</sub>) of the Wakino Subgroup at Kumagai. Kokura-kita-ku. Kitakyushu City, SW Japan. Collect. no. KA-O-6d<sub>2</sub>, 6c<sub>1</sub>; KA-O-3: 5, 10, Cat. no. KMNH IvP 500,020–500,023.

**Description:** Carapace of small size, elliptical in outline, 6.3–6.7 mm long, 3.3–4.1 mm high. Dorsal margin ill-preserved, with narrow umbo at its centre. Both of anterior and posterior margins rounded, ventral margin broadly curved downwards. Growth bands narrow, 30–36 in number ornamented with radial striae and fine cross bars in between.

**Remarks:** For *Estherites* the type species, *E. mitsuishii* (KOBAYASHI & HUZITA, 1942, pl. 2, fig. 2), was found from the Upper Cretaceous Nenjiang Formation of the Sungari Group in NE China. Its growth bands ornamented with large and deep cavernous sculpture which are irregular tubecles in the external mould of valve. Based on the sculpture of radial striae with cross bars in between, it may be recognizable to refer *E. imamura* KUSUMI to the genus *Ortheastheriopsis*.

*Ortheastheriopsis guantouensis* CHEN & SHEN associated with *Ortheastheria kokurensis* in Aptian deposits of Zhejiang Province, SE China is extremely similar to *O. imamura* (KUSUMI) in outline of carapace and in ornamentation of growth bands. It is probably a junior synonym of this Japanese species.

KUSUMI (1960) described 9 specimens under this species, they are 4.9–6.8 mm long, 2.9–4.0 mm high, 22–38 growth bands. It differs from *O. kokurensis* not only in subcentral umbo of dorsal margin, but also in having cross bars between the radial striae of growth bands.

**Locality and horizon:** Same as *O. kokurensis* (KUSUMI), they are associated each other.

***Ortheastheriopsis wakinoica* sp. n.**

(Pl. 3, figs. 6–9; Pl. 4, figs. 1–6)

- 1960 Genus and species indet. (C form), KUSUMI: Jour. Sci. Hiroshima Univ., Ser. C, vol. 3, no. 1, p. 22, pl. 4, figs. 7–9, 12.  
1961 C form, KUSUMI, Geol. Rep. Hiroshima Univ. no. 7, pl. 6, figs. 7–8.  
1978 *Cyclestherioides* sp., KUSUMI: Rep. second excav. Cret. fish fossils in Kokura, Kitakyushu City, Japan, p. 17–19, pl. 13, figs. 6–8.

**Holotype:** Cat. no. KMNH IvP 500,024, Collect. no. KA-O-3: 1a collected from the Upper Wakamiya Formation (W<sub>4</sub>) of the Wakino Subgroup at Kumagai, Kokura-kita-ku, Kitakyushu City, SW Japan.

**Paratypes:** Collect. no. KA-O-3: 1b–3, 5–9, 11; KA-O-6d: 3–8; KA-O-6c: 2–5, Cat. no. KMNH IvP 500,025–500,043.

**Description:** Carapace of small size, bucket-form in outline, 3.7–4.7 mm long, 3.9–5.0 mm high, high equal or slightly more than long. Dorsal margin short with central umbo, anterior and posterior margins relatively straight, ventral margin circular downwards or somewhat expansive obliquely. Growth bands relatively wide in the central part of valve but close-set near the umbonal and ventral sides, ornamented with crowded linearized granules and strips in the external mould near ventral half (Pl. 4, fig. 5), and slender striae intercalated with short one near the dorsal half (Pl. 3, fig. 7; Pl. 4, fig. 6).

**Remarks:** Those specimens named and figured by KUSUMI (1960, 1961, 1978) as “C form” or *Cyclestherioides* sp. from the Upper Wakamiya Formation in Kokura area of SW Japan have never been described. The type-species of *Cyclestherioides*, *Estheria lenticularis* MITCHELL, was found from the Upper Permian rocks of the Syney Basin. The author borrowed and observed its holotype from Australia Museum (N. H.) during his staying in Canberra in 1994. He found the holotype of *E. lenticularis* is an internal mould of the left valve without sculpture in growth bands. So the present author prefers to rename the “C form” *Ortheastheriopsis wakinoica* sp. n. because it has radial striae with cross bars in between of the growth bands near the ventral half of valve. This new species differs from all others of *Ortheastheriopsis* in having slender striae intercalated with short one near the dorsal half. It is also similar to *Ortheastheria linguliformis* and *O. wangzhuangensis* (CHEN & SHEN, 1982, pl. 22, figs. 3–6; pl. 23, fig. 4) in characteristic bucket-form outline of carapace, but the latter two species differ from the former in having no cross bars between the radial striae and no intercalated slender and short striae near the dorsal half of valve.

**Locality and horizon:** Same as above-mentioned two species of this genus.

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### References

- CHANG, K. H. 1985. Synopsis of Cretaceous Stratigraphy of Kyongsang Basin with special reference to "Syntectosome", a new concept. *Jour. Nat. Sci. Kyungpook National Univ.*, **3**: 89–101.
- CHEN, P. J. & Z. L. CHANG. 1994. Nonmarine Cretaceous stratigraphy of eastern China. *Cretaceous Research*, **15**(3): 245–257.
- CHEN, P. J. & Y. B. SHEN. 1982. Late Mesozoic conchostracans from Zhejiang, Anhui and Jiangsu provinces. *Palaeontologia Sinica, New series B*, no. 17, 117 pp., 47 pls. (In Chinese with English summary).
- CHI, Y. S. 1931. On the occurrence of fossil *Estheria* in China and its geological significance. *Bull. Geol. Soc. China*, **10**: 189–223.
- KOBAYASHI, T. 1954. Fossil Estherians and allied fossils. *Jour. Sci. Univ. Tokyo, Sec. 2*, **9**, pt. 1, 192 pp.
- KOBAYASHI, T. & A. HUZITA. 1942. *Estheria* in Cretaceous Sungari Series. *Jour. Sci. Univ. Tokyo, Sec. 2*, **6**, pt. 7, p. 107–128, pl. 1–2.
- KOBAYASHI, T. & Y. KIDO. 1947. Cretaceous *Estherites* from the Kyongsang group in the Tsushima basin. *Jap. Jour. Geol. Geogr.*, **20**(2–4): 83–90, pl. 18–19.
- KUSUMI, H. 1960. On the occurrence of Cretaceous Estherids in North Kyushu. *Jour. Sci. Univ. Hiroshima, Series C*, **3**(1): 15–24, pl. 4.
- KUSUMI, H. 1961. Studies on the fossil Estherids with special reference to recent estherids. *Geol. Rep. Univ. Hiroshima*, no. 7, 88 pp., 9 pls. (In Japanese with English Summary).
- KUSUMI, H. 1978. Fossil conchostracans from Kokura of Kitakyushu. in OTA, M *et al.* (eds.), *The report of the second excavation for the Cretaceous fish fossils in Kokura, Kitakyushu City, Japan*, pp. 17–19, pl. 13 (In Japanese).
- OTA, M., R. TORIYAMA, Y. HOJO, T. SOTSUKA, T. NISHIDA, A. FUJII, A. SUGIMURA, T. HAIKAWA, K. NAGAI & T. SUGIYAMA. 1979. Geology of the Kanmon Group in the southern district of Kokura, Kitakyushu City. *Bull. Kitakyushu Mus. Nat. Hist.*, **1**: 1–10. (In Japanese with English abstract).
- OTA, Y. 1960. The zonal distribution of the non-marine fauna in the Upper Mesozoic Wakino Subgroup. *Mem. Fac. Sci. Univ. Kyushu, Series D*, **9**(3): 187–209.
- REIBLE, P. 1962. Die conchostraken (Branchiopoda, Crustacea) der Germanischen Trias. *N. Jb. Geol. Pal. Abh. Bd.*, **114**, pt. 2, S. 169–244, taf. 6–10.
- YABUMOTO, Y. 1994. Early Cretaceous freshwater fish fauna in Kyushu, Japan. *Bull. Kitakyushu Mus. Nat. Hist.*, **13**: 107–254, 59 pls.
- ZHANG, W. T., P. J. CHEN & Y. B. SHEN. 1976. *Fossil Conchostraca of China*. 325 pp., 138 pls. (In Chinese), Science Press, Beijing.

# Lower Cretaceous Conchostracans of SW Japan

CHEN Pei-ji

**Plates 1-4**

### Explanation of Plate 1

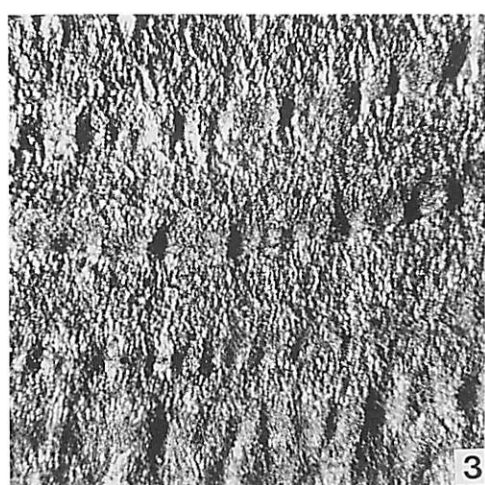
figs 1–5. *Yanjiestheria chekiangensis* (NOVOJILOV)

1. right valve.  $\times 5$ , IK-2a, KMNH IvP 500,007
2. sculpture of growth bands of fig. 1.  $\times 40$
3. sculpture.  $\times 40$ , IK-1, KMNH IvP 500,006
4. left valve.  $\times 4$ , IK-19a, KMNH IvP 500,009
5. an opening valves.  $\times 7$ , IK-14, KMNH IvP 500,008

figs. 6–8. *Yanjiestheria huzitai* (KOBAYASHI & KIDO)

6. left valve.  $\times 4$ , IK-2b, KMNH IvP 500,004
7. sculpture of growth bands of fig. 6.  $\times 40$
8. right valve.  $\times 4$ , IK-19b, KMNH IvP 500,005

All of above-mentioned specimens are from the Yamaji shale of the Inakura Formation near Yamaji, Ibara City, Okayama Prefecture, SW Japan.



## Explanation of Plate 2

figs 1–2. *Yanjiestheria kyongsangensis* (KOBAYASHI & KIDO)

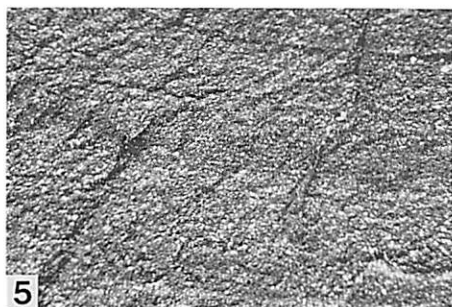
1. external mould of right valve.  $\times 5$ , IK-5, KMNH IvP 500,001
2. sculpture of growth bands of, fig. 1.  $\times 40$

figs. 3–7. *Neodiestheria yamajensis* sp. n.

3. holotype, an external mould of left valve.  $\times 7$ , IK-18, KMNH IvP 500,013
4. paratype, left valve.  $\times 5$ , IK-3, KMNH IvP 500,014
5. sculpture of growth bands of fig. 3.  $\times 40$
6. sculpture of same specimen.  $\times 20$
7. sculpture of growth bands.  $\times 20$ , IK-21, KMNH IvP 500,015

All of above-mentioned specimens are from the Yamaji shale of the Inakura Formation near Yamaji, Ibara City, Okayama Prefecture, SW Japan.





### Explanation of Plate 3

figs. 1–2. *Ortheastheria kokurensis* (KUSUMI)

1. internal mould of an opening valves.  $\times 7$ , KA-O-6d<sub>1</sub>, KMNH IvP 500,019
2. right valve.  $\times 7$ , KA-O-6d<sub>9</sub>, KMNH IvP 500,018

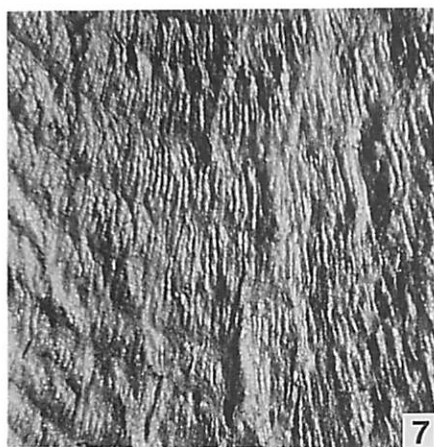
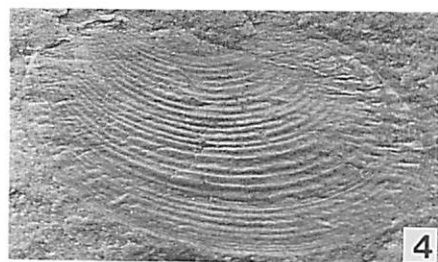
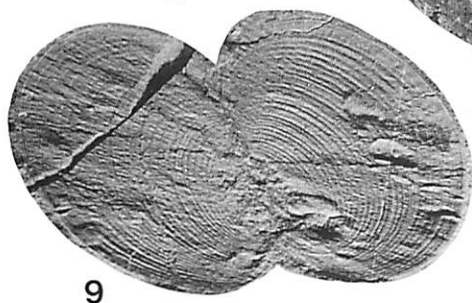
figs. 3–5. *Ortheastheriopsis imamura* (KUSUMI)

3. external mould of right valve.  $\times 10$ , KA-O-6d<sub>2</sub>, KMNH IvP 500,020
4. internal mould of left valve.  $\times 10$ , KA-O-6c<sub>1</sub>, KMNH IvP 500,021
5. sculpture of growth bands of fig. 3.  $\times 40$ .

figs. 6–9. *Ortheastheriopsis wakinoica* sp. n.

6. holotype, an external mould of right valve.  $\times 10$ , KA-O-3:1a, KMNH IvP 500,024
7. sculpture of growth bands of fig. 6.  $\times 40$
8. left valve.  $\times 10$ , KA-O-3: 1b, KMNH IvP 500,025
9. external mould of an opening valves with extruding deformation.  $\times 7$ , KA-O-6d<sub>3</sub>, KMNH IvP 500,034

All above-mentioned specimens in this plate are from the Upper Wakamiya Formation (W<sub>4</sub>) of the Wakino Subgroup at Kumagai, Kokura-kita-ku, Kitakyushu City, SW Japan.



### Explanation of Plate 4

figs. 1-6. *Ortheastheriopsis wakinoica* sp. n.

1. external mould of right valve with extruding deformation.  $\times 10$ , KA-O-6d<sub>4</sub>, KMNH IvP 500,035
2. another external mould of right valve with extruding deformation.  $\times 10$ , KA-O-6d<sub>6</sub>, KMNH IvP 500,037
3. right valve.  $\times 10$ , KA-O-6d<sub>7</sub>, KMNH IvP 500,038
4. sculpture of growth bands near umbo of pl. 3, fig. 9.  $\times 40$
5. sculpture near ventral side of fig. 2.  $\times 40$
6. sculpture near umbo side of pl. 3, fig. 6.  $\times 80$

All above-mentioned specimens are from the Upper Wakamiya Formation (W<sub>4</sub>) of the Wakino Subgroup at Kumagai, Kokura-kita-ku, Kitakyushu City, SW Japan.

figs. 7-8. *Yanjiestheria* aff. *brevis* CHEN & SHEN

7. external mould of right valve.  $\times 7$ , IK-7, KMNH IvP 500,011
8. sculpture of growth bands.  $\times 40$ , IK-12, KMNH IvP 500,012

These two specimens are collected from the Yamaji shale of the Inakura Formation, Inkstone Group near Yamaji, Ibara City of Okayama Prefecture, SW Japan.

